

PCT

WORLD INTELLECTUAL PROPERTY ORGANIZATION  
International Bureau



INTERNATIONAL APPLICATION PUBLISHED UNDER THE PATENT COOPERATION TREATY (PCT)

<p>(51) International Patent Classification<sup>6</sup>: <b>B29C 51/42</b></p>	<p><b>A1</b></p>	<p>(11) International Publication Number: <b>WO 97/48543</b> (43) International Publication Date: 24 December 1997 (24.12.97)</p>
<p>(21) International Application Number: PCT/US97/10094 (22) International Filing Date: 9 June 1997 (09.06.97) (30) Priority Data: 08/664,353 17 June 1996 (17.06.96) US (60) Parent Application or Grant (63) Related by Continuation US 08/664,353 (CON) Filed on 17 June 1996 (17.06.96) (71) Applicant (for all designated States except US): THE GILLETTE CANADA INC. [CA/CA]; 16700 Trans Canada, Kirkland, Quebec H9H 4Y8 (CA). (72) Inventors; and (75) Inventors/Applicants (for US only): HICKS, Robert, L. [US/US]; 3116 Juniper Drive, Iowa City, IA 52245 (US). LUEBBERT, Lawrence, H. [US/US]; 1958 Delwood Drive, Iowa City, IA 52240 (US). KONOP, Gary, L. [US/US]; 33 Heron Circle, Iowa City, IA 54225 (US). (74) Agents: GALLOWAY, Peter, D.; Ladas &amp; Parry, 26 West 61 Street, New York, NY 10023 (US) et al.</p>		<p>(81) Designated States: AL, AM, AT, AU, AZ, BA, BB, BG, BR, BY, CA, CH, CN, CU, CZ, DE, DK, EE, ES, FI, GB, GE, GH, HU, IL, IS, JP, KE, KG, KP, KR, KZ, LC, LK, LR, LS, LT, LU, LV, MD, MG, MK, MN, MW, MX, NO, NZ, PL, PT, RO, RU, SD, SE, SG, SI, SK, TJ, TM, TR, TT, UA, UG, US, UZ, VN, YU, ARIPO patent (GH, KE, LS, MW, SD, SZ, UG), Eurasian patent (AM, AZ, BY, KG, KZ, MD, RU, TJ, TM), European patent (AT, BE, CH, DE, DK, ES, FI, FR, GB, GR, IE, IT, LU, MC, NL, PT, SE), OAPI patent (BF, BJ, CF, CG, CI, CM, GA, GN, ML, MR, NE, SN, TD, TG).  <b>Published</b> <i>With international search report.</i> <i>Before the expiration of the time limit for amending the claims and to be republished in the event of the receipt of amendments.</i></p>
<p>(54) Title: METHOD OF FORMING BLISTER PACK PACKAGING</p> <div data-bbox="357 1134 1266 1554"></div> <p>(57) Abstract</p> <p>A method of forming blister pack packaging is provided including providing a thermoplastic material (10) and placing the thermoplastic material (10) between a pair of opposed male (24) and female (22) thermoforming dies, while cooling a portion of at least one of the dies (22, 24). The cooled portion of the die is positioned to contact the area of the thermoplastic material in which it is desired to avoid distortion.</p>		

**FOR THE PURPOSES OF INFORMATION ONLY**

Codes used to identify States party to the PCT on the front pages of pamphlets publishing international applications under the PCT.

AL	Albania	ES	Spain	LS	Lesotho	SI	Slovenia
AM	Armenia	FI	Finland	LT	Lithuania	SK	Slovakia
AT	Austria	FR	France	LU	Luxembourg	SN	Senegal
AU	Australia	GA	Gabon	LV	Latvia	SZ	Swaziland
AZ	Azerbaijan	GB	United Kingdom	MC	Monaco	TD	Chad
BA	Bosnia and Herzegovina	GE	Georgia	MD	Republic of Moldova	TG	Togo
BB	Barbados	GH	Ghana	MG	Madagascar	TJ	Tajikistan
BE	Belgium	GN	Guinea	MK	The former Yugoslav Republic of Macedonia	TM	Turkmenistan
BF	Burkina Faso	GR	Greece	ML	Mali	TR	Turkey
BG	Bulgaria	HU	Hungary	MN	Mongolia	TT	Trinidad and Tobago
BJ	Benin	IE	Ireland	MR	Mauritania	UA	Ukraine
BR	Brazil	IL	Israel	MW	Malawi	UG	Uganda
BY	Belarus	IS	Iceland	MX	Mexico	US	United States of America
CA	Canada	IT	Italy	NE	Niger	UZ	Uzbekistan
CF	Central African Republic	JP	Japan	NL	Netherlands	VN	Viet Nam
CG	Congo	KE	Kenya	NO	Norway	YU	Yugoslavia
CH	Switzerland	KG	Kyrgyzstan	NZ	New Zealand	ZW	Zimbabwe
CI	Côte d'Ivoire	KP	Democratic People's Republic of Korea	PL	Poland		
CM	Cameroon	KR	Republic of Korea	PT	Portugal		
CN	China	KZ	Kazakhstan	RO	Romania		
CU	Cuba	LC	Saint Lucia	RU	Russian Federation		
CZ	Czech Republic	LI	Liechtenstein	SD	Sudan		
DE	Germany	LK	Sri Lanka	SE	Sweden		
DK	Denmark	LR	Liberia	SG	Singapore		
EE	Estonia						

## METHOD OF FORMING BLISTER PACK PACKAGING

### Background of the Invention

5       The present invention relates to methods of forming blister pack packaging.

      Articles to be displayed for retail sale are frequently packaged in "blister pack" packaging. A blister pack includes a flat backing sheet, generally of cardboard or plastic, and a plastic "bubble" or "blister", generally of transparent plastic, the backing sheet and blister being joined to form a sealed cavity in which the article rests.

      The blister portion of the packaging may be formed by thermoforming a region of a planar plastic material to a desired shape, e.g., by placing the plastic material between a pair of male and female dies that are temperature controlled at a temperature sufficient to soften the plastic and pressing the male and female dies together to form an indentation or "blister" in the plastic.

20       This process for forming the blister portion is generally effective, but tends to create distortion of the plastic which can be undesirable. In particular, because of this distortion, it is often difficult or impossible to use a plastic material having a decorative graphic pre-printed on it, as the graphic will also be distorted. As a result, any desired graphics are typically applied in a separate processing step, e.g., by applying a decal and/or label to the thermoformed plastic.

### Summary of the Invention

30       In one aspect, the invention features an improved method of forming blister pack packaging. Advantageously, the method of the invention allows a blister pack to be thermoformed using preprinted plastic material without

undesirable deformation of the plastic material and thus the printing on the plastic. The method of the invention may also allow decals or labels to be applied to a printed or non-printed plastic material prior to thermoforming, without  
5 risk of damage to the decal or label during the thermoforming process. The method of the invention also provides excellent control over the wall thickness of the thermoformed blister.

The method of the invention includes providing a  
10 substantially planar thermoplastic material and placing the thermoplastic material between a pair of opposed male and female thermoforming dies, while cooling a portion of at least one of the dies. The cooled portion of the die is positioned to contact the area of the thermoplastic material  
15 in which it is desired to avoid distortion. By "cooling", it is meant that the temperature of the die is reduced relative to its normal operating temperature; because the normal operating temperature of the die may be significantly higher than room temperature, due to friction, "cooling" is  
20 meant to include reducing the temperature of the die to a temperature higher than room temperature but lower than the temperature that the die would be at were it not cooled.

Preferred embodiments include one or more of the following features. A portion of the male die is cooled and  
25 the female die is temperature controlled to maintain the female die at a sufficient temperature to allow the plastic material used to be thermoformed. The male die includes (a) a metal head that has a bore for the passage of water to cool the metal head, and (b) insulating sidewalls on each  
30 side of the metal head. The thermoplastic material is preheated prior to being placed between the dies. The female die is a vacuum forming die.

In another aspect, the invention features a thermoforming system for forming blister pack packaging, including opposed male and female dies, one of which includes a cooled portion. Preferably a portion of the male die is cooled, as described above.

Other features and advantages of the invention will be apparent from the description of preferred embodiments thereof, taken together with the drawings, and from the claims.

#### Brief Description of the Drawings

Fig. 1 is schematic perspective view of a production line utilizing a method according to one embodiment of the invention.

Figs. 2 and 2a are cross-sectional views, taken along lines 2-2 and 2A-2A, respectively, of the thermoforming die used in the production line shown in Fig. 1.

Fig. 3 is a cross-sectional view of a male die according to an alternate embodiment of the invention, taken along line 2-2 of Fig. 1.

Fig. 4 is a cross-sectional view of a male die according to yet another alternate embodiment of the invention, taken along line 2A-2A in Fig. 1.

#### Description of the Preferred Embodiments

A preferred method according to the invention is shown in Fig. 1. According to this method, a planar plastic material 10 having a plurality of graphics 12 (preprinted, labels or decals) spaced at intervals on its surface, is unrolled from a roll 14. The plastic is first preheated by any desired heating device 16, as is well known in the vacuum forming art. The preheating temperature will depend upon the plastic used, as would be understood by those

skilled in the art, but will generally be from about 175°C to 230°C. Next, the plastic is passed through a registration device 18, which may be any desired type of registration device, e.g., optical or mechanical, for  
5 registration of the spacing of the graphics 12. The plastic passes next to the vacuum forming station 20.

The vacuum forming station 20 includes a heated female thermoforming cavity 22 and a chilled male thermoforming die 24. The female cavity 22 is preferably  
10 temperature controlled to maintain its temperature constant at about 20 to 80°C, depending upon the plastic used, as would be understood by one skilled in the art. The male die is chilled to a predetermined temperature, e.g., from about -10°C to 30°C, generally about 4°C to 25°C, to prevent  
15 distortion of the plastic during thermoforming. The temperature selected will depend upon the plastic used; for example, a suitable temperature for polyvinyl chloride (PVC) is 15°C. Suitable temperatures for other plastics could be readily determined by one skilled in the art by trial and  
20 error; a suitable temperature is one at which little or no distortion of a preprinted graphic is observed. It is preferred that the male die contact the plastic first, prior to the plastic contacting the female cavity, for optimum control of plastic distortion.

25 Preferably, only the tip portion 26 of the male die is chilled, so as not to interfere with thermoforming of the plastic by the sidewalls of the male die. Depending upon the location of the graphic 12 on the blister, different areas of the die may be chilled. However, in most cases at  
30 least a portion of the die should not be chilled, to ensure proper thermoforming.

Chilling of the tip portion of the male die may be accomplished by providing a male die as shown in Figs. 2 and

2a. Male die 24 includes a core 27 having a cooling channel 28 extending along its length, the cooling channel having an inlet 30 and an outlet 32 and being positioned adjacent the tip portion 26 of the die. Cooling channel 28 allows cold  
5 water or other chilled fluid to be channeled through the die continuously during the thermoforming process. Suitable channel diameters are those which are sufficiently small to fit within a desired width die, yet sufficiently large to provide a desired degree of cooling with the fluid used, as  
10 would be understood by one skilled in the art. In the embodiment shown, the diameter of the channel is preferably from about 3 to 4 mm.

Preferably, the core 27 is formed of metal or other highly thermally conductive material, for most effective  
15 cooling. The remainder of the male die (the sidewalls 31 of the die) is preferably constructed of a thermally insulative material, e.g., insulating laminates such as those commercially available from McMaster-Carr, Chicago, IL, under the tradenames GAROLITE and YOROLITE, or syntactic  
20 composites, e.g., those available from Emerson & Cuming, Canton, MA, under the tradename SYNTAC<sup>R</sup> 350. Preferred insulating materials have a thermal conductivity of from about 0.1 to 0.2 W/(m x K).

If the side walls of the male die are too cold for a  
25 given application, an alternative die can be used, as shown in Fig. 3, in which a further insulating layer 34 is provided between the core 27 and the sidewalls 31. Insulating layer 34 may be any desired insulative material, e.g., a fiberglass sheet material such as that available  
30 under the tradename YOROLITE, from McMaster-Carr.

Other embodiments are within the claims. For example, any desired cooling method can be used to cool a portion of the die, e.g., a refrigeration loop, as would be

understood by one skilled in the art. Moreover, other fluids can be used to cool the die, rather than water, e.g., glycols, for example, ethylene glycol, or compressed air.

Further, as shown in Fig. 4, cooling channel 28 can  
5 run directly from the inlet to the outlet, without extending downward towards the tip of the die as shown in Fig. 2A. The die shown in Fig. 4 is more economical to manufacture, and thus may be advantageous if the die materials are selected to allow sufficient cooling of the tip to be  
10 obtained with this configuration of the cooling channel.



CLAIMS

1           1. A method of forming blister pack packaging  
2 comprising:  
3           providing a substantially planar thermoplastic  
4 material, and  
5           placing a portion of the thermoplastic material  
6 between a pair of opposed male and female thermoforming  
7 dies, while cooling a portion of at least one of the dies,  
8 wherein the cooled portion of the die is positioned to  
9 contact an area of the thermoplastic material in which it is  
10 desired to avoid distortion.

1           2. A method of claim 1 wherein a portion of the  
2 male die is cooled.

1           3. A method of claim 2 wherein said portion of the  
2 male die is cooled to a temperature between about -10° and  
3 30°C.

1           4. A method of claim 3 wherein said portion of the  
2 male die is cooled to a temperature between about 4° and  
3 25°C.

1           5. A method of claim 2 wherein the female die is  
2 temperature controlled at a predetermined temperature  
3 sufficient to allow thermoforming of the thermoplastic.

1           6. A method of claim 2 wherein the male die  
2 includes (a) a metal head that has a bore for the passage of  
3 a cooling fluid to cool the metal head, and (b) insulating  
4 sidewalls on each side of the metal head.

1           7. A method of claim 6 wherein said cooling fluid  
2 is water.

1           8. A method of claim 6 wherein said cooling fluid  
2 is a glycol.

1           9. A method of claim 1 wherein the thermoplastic  
2 material is preheated prior to being placed between the  
3 dies.

1           10. A method of claim 1 wherein the female die is a  
2 vacuum forming cavity.

1           11. A device for use in forming blister pack  
2 packaging comprising  
3           (a) a female thermoforming cavity, constructed to be  
4 maintained at a predetermined temperature sufficient to  
5 thermoform a thermoplastic material; and  
6           (b) a male die, in opposed spaced relation to said  
7 female thermoforming cavity, comprising a cooling channel  
8 constructed for fluid flow of cooling fluid through the die.

FIG.1

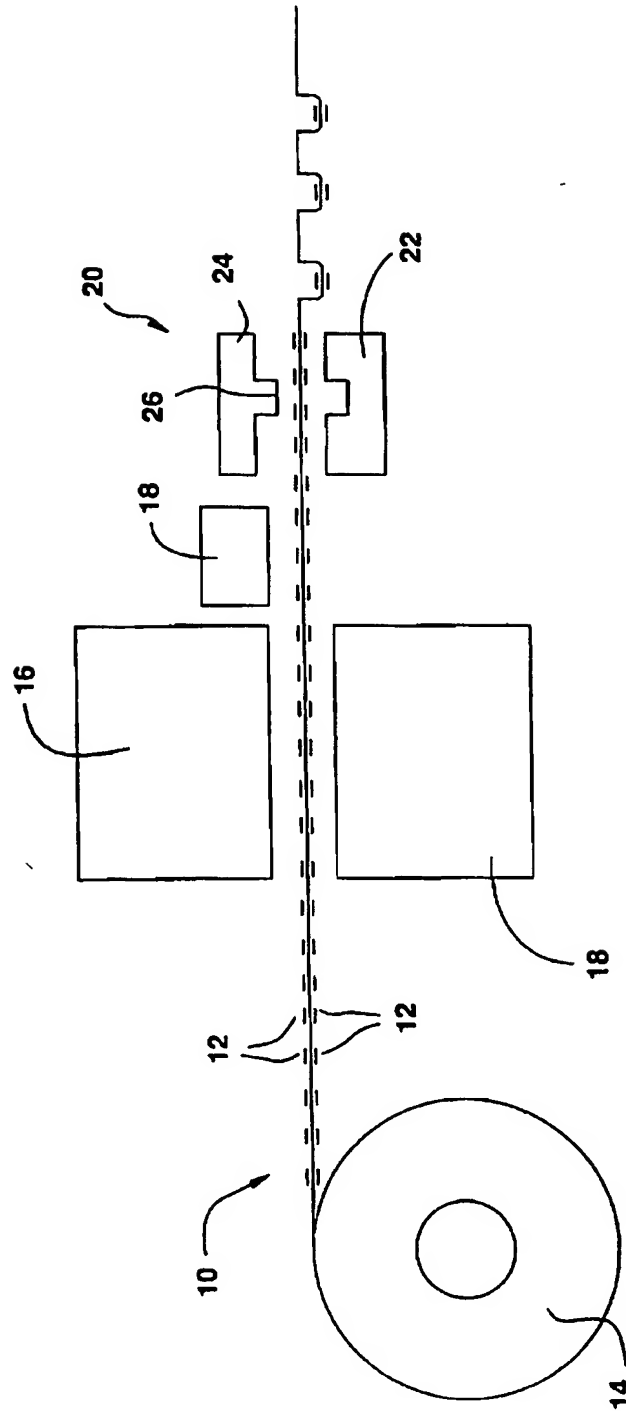
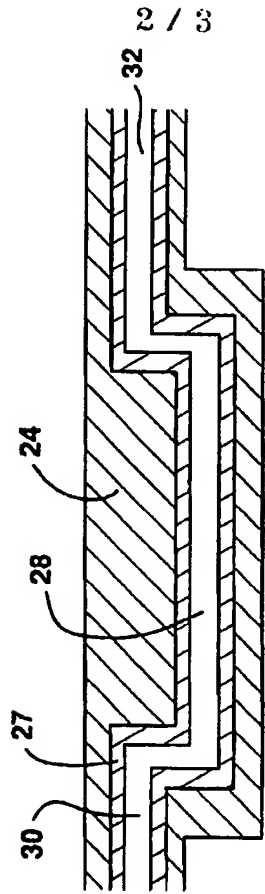
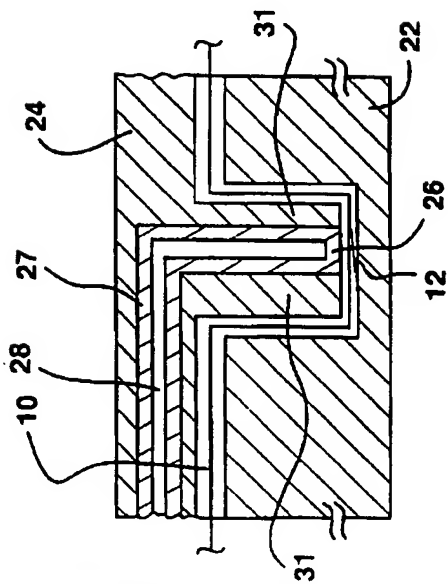


FIG. 2A



**FIG. 2**



**SUBSTITUTE SHEET (RULE 26)**

3 / 3

FIG.4

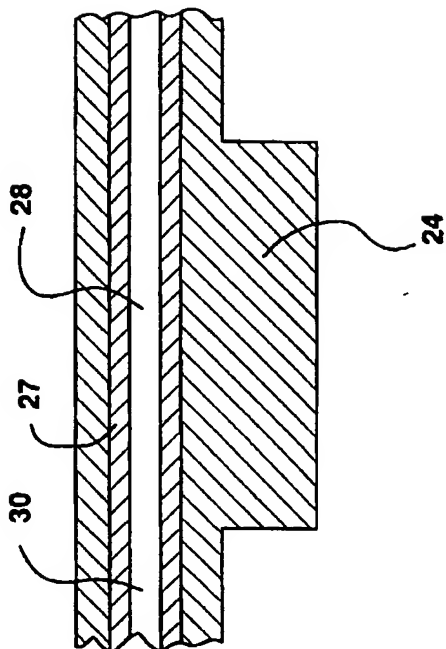
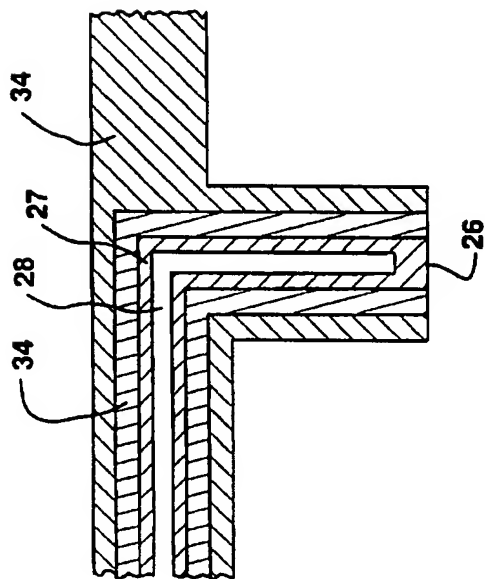


FIG.3



SUBSTITUTE SHEET (RULE 26)

# INTERNATIONAL SEARCH REPORT

International Application No.  
PCT/US 97/10094

A. CLASSIFICATION OF SUBJECT MATTER  
IPC 6 B29C51/42

According to International Patent Classification (IPC) or to both national classification and IPC

## B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)  
IPC 6 B29C

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practical, search terms used)

## C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category *	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
P,X	US 5 545 370 A (MOREN MIKE ET AL) 13 August 1996 see abstract see column 4, line 61 - column 5, line 35; figures ---	1-5,7, 10,11
A	GB 1 416 818 A (STANDARD TELEPHONES CABLES LTD) 10 December 1975 see claims; figures ---	1,2,9-11
A	PATENT ABSTRACTS OF JAPAN vol. 010, no. 381 (M-547), 19 December 1986 & JP 61 172722 A (MIYUUCHIYUARU:KK), 4 August 1986, see abstract --- -/-	1,9,11

☒ Further documents are listed in the continuation of box C.

☒ Patent family members are listed in annex.

### \* Special categories of cited documents :

- \*A\* document defining the general state of the art which is not considered to be of particular relevance
- \*E\* earlier document but published on or after the international filing date
- \*L\* document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)
- \*O\* document referring to an oral disclosure, use, exhibition or other means
- \*P\* document published prior to the international filing date but later than the priority date claimed

- \*T\* later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention
- \*X\* document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone
- \*Y\* document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art.
- \*&\* document member of the same patent family

Date of the actual completion of the international search

3 October 1997

Date of mailing of the international search report

27 OCTOBER 1997

Name and mailing address of the ISA  
European Patent Office, P.B. 5818 Patentlaan 2  
NL - 2280 HV Rijswijk  
Tel. (+31-70) 340-2040, Tx. 31 651 epo nl  
Fax: (+31-70) 340-3016

Authorized officer

Kosicki, T

# INTERNATIONAL SEARCH REPORT

International Application No.

PCT/US 97/10094

## C. (Continuation) DOCUMENTS CONSIDERED TO BE RELEVANT

Category *	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	US 4 420 454 A (KAWAGUCHI KIYOSHI ET AL) 13 December 1983 see page 3, line 55 - line 88; figures 1-6 ---	1,2,9,11
A	GB 2 052 365 A (PLM AB) 28 January 1981 see figures ---	1,2,9,11
A	PATENT ABSTRACTS OF JAPAN vol. 018, no. 426 (P-1784), 9 August 1994 & JP 06 131228 A (JUST SYST CORP), 13 May 1994, see abstract -----	1

# INTERNATIONAL SEARCH REPORT

Information on patent family members

International Application No

PCT/US 97/10094

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
US 5545370 A	13-08-96	NONE	
GB 1416818 A	10-12-75	NONE	
US 4420454 A	13-12-83	NONE	
GB 2052365 A	28-01-81	SE 424285 B	12-07-82
		BE 883731 A	10-12-80
		CA 1240115 A	09-08-88
		CH 649249 A	15-05-85
		DE 3020967 A	18-12-80
		FR 2458373 A	02-01-81
		HK 45388 A	24-06-88
		JP 1735232 C	17-02-93
		JP 2238924 A	21-09-90
		JP 4022689 B	20-04-92
		JP 1615889 C	30-08-91
		JP 2037291 B	23-08-90
		JP 56002144 A	10-01-81
		NL 8003110 A	15-12-80
		SE 7905042 A	12-12-80
		US 4374166 A	15-02-83